



# **City of Salina Raw Water Supply Study**

**Citizen's Advisory Board  
Workshop**

**January 29, 2009  
6:00 PM**

**HDR**



# Introductions



- City Staff

- Martha Tasker, Director of Utilities
- Kurt Williams, Plant Operations Manager
- Jeff Cart, Utilities Supervisor
- Steve Palmer, Utility Engineer



- Consultants

- HDR
  - Donald Lindeman, Project Manager
  - Lorrie Hill, Project Engineer
- Wilson & Company
  - Jason Schlickbernd, Asst. Project Manager
- Layne Christensen
  - Luca DeAngelis Hydrogeologist

Questions?

Contact: **Martha Tasker**

Phone: **785-309-5725**

E-Mail: **[martha.tasker@salina.org](mailto:martha.tasker@salina.org)**





# Introductions



- Citizens Advisory Board Members



Dan Ade

Todd Anderson

Gina Bell

Robert Bostater

Beth Eisenbraun

Tim Hobson

Mike Hulteen

Brian Kinnaird

Harold Klaege

James Maes

Charles May

John Ourada

Lawrence Wetter





# Agenda for Tonight



- Review of Study Objectives
  - Purpose of Citizens Advisory Board
  - Scope of the Raw Water Supply Study
- Recap of last CAB meeting
  - Conservation
  - Water Reuse
- New Sources of Supply
- Alternatives Evaluation Criteria





# Raw Water Supply Study



- Purpose of Study
  - Recent drought conditions
  - Contamination issues near wellfields
  - Strained ability of City to maintain adequate water supply for customers
  - Identify sustainable solutions for next 50 years
  - Diversify water supply sources
- CAB meetings at key project milestones
  - August, 2008 - Demand projections, water rights
  - November, 2008 – Future regulatory impacts, existing facilities
  - December, 2008 - Conservation, reuse
  - January, 2009 – New Sources of Supply
  - February, 2009 – Alternatives
  - March, 2009 – Draft Report





# Recap of Last CAB Meeting - Conservation

- Current Requirements (2007 KWO Guidelines)
  - Lists highly recommended water use efficiency practices
    - Water bills show amount of water used in gallons
    - All meters be repaired and replaced regularly
  - Private wells may be included in drought response if approved by the Chief Engineer of Division of Water Resources (DWR)
- Recommended Modifications to Existing Plan
  - Water use efficiency goal be reduced from 130 gallons per capita per day (gpcd) to 126 gpcd
  - Include private wells within the city limits in the drought response
  - Modify the trigger points for Water Watch, Water Warning and Water Emergency



# Conservation Measures – CAB Results

Order of Importance of Implementation	Type of Measure	Potential Water Conservation Measure	Total Points Received During Rating
1	Outreach and Education	Understandable and Informative Water Bill	33
2	Outreach and Education	Water Conservation Classes	32
3	Outreach and Education	Teaching Water Conservation in Schools	32
4	Rate Structure	Water Emergency Water Rates*	32
5	Rate Structure	Conservation Based Water Rate Structure*	31
6	Outreach and Education	Conservation packets, brochures, newsletter articles, etc.*	30
7	System	Water Loss Control Program*	29
8	Outreach and Education	High Use Notifications	29
9	Outreach and Education	Bill Inserts – Monthly Water Saving Tips*	29
10	Commercial & Industrial Incentive Program	Commercial High-Efficiency Toilets	29
11	Outreach and Education	Public Awareness for Commercial & Industrial (placards, stickers, etc.)	29
12	Outreach and Education	Water Conservation Website*	28
13	Rebate Program	High Efficiency or Low Flow Toilets Rebate	28
14	Commercial & Industrial Incentive Program	Water Savings Project Program	28
15	System	Water Meter Maintenance Program*	27
16	Outreach and Education	Local Newspaper Ads*	27
17	Rebate Program	Rain Sensors Rebate	27
18	Landscaping Ordinance	Water Waste Ordinance*	27
19	Outreach and Education	Water Conservation Garden	26
20	Commercial & Industrial Incentive Program	Commercial Low Flow Toilets	26



# Conservation Measures – Final Top 10

Type of Measure	Potential Water Conservation Measure
• Outreach and Education	Understandable and Informative Water Bill
• Outreach and Education	Water Conservation Classes
• Outreach and Education	Teaching Water Conservation in Schools
• Outreach and Education	High Use Notifications
• Outreach and Education	Public Awareness for Commercial & Industrial (placards, stickers, etc.)
• Commercial & Industrial Incentive Program	Commercial High-Efficiency Toilets
• Rebate Program	High Efficiency or Low Flow Toilets Rebate
• Rebate Program	High Efficiency Clothes Washer Rebate
• Outreach and Education	Water Conservation Garden
• Ordinance	Xeriscape Ordinance

\* The City should continue to implement all their current water conservation measures

\*Conservation is not an additional supply,  
it delays the development timing for additional sources



# Water Reuse Types

- Agricultural Irrigation (crops)
- Landscape Irrigation
  - Parks, athletic fields, golf courses
- Non-Potable Urban Use
  - Fire protection, toilet flushing, dust control, street sweeping
- Industrial Recycling
  - Cooling water, process water
- Groundwater Recharge
- Potable Reuse
  - Blending with water supply, direct (pipe-to-pipe) reuse





# State Regulations



- KS Dept of Health & Environment (KDHE)
- Design criteria for irrigation use
  - See next slide
- Update National Pollutant Discharge Elimination (NPDES) permit
  - Water quality limitations
  - Special conditions for irrigation
    - Irrigate at times when public access is restricted
    - Avoid runoff onto adjacent lands
    - Signage warning of reclaimed wastewater
    - Prevent ponding on ground surface





# KDHE Design Criteria

Projected Use of Effluent	Minimum Required Treatment Level	Loading Rates for All Uses
Athletic fields, highway rest areas, or public parks with a high probability of body contact	Secondary Treatment Filtration Disinfection	<ul style="list-style-type: none"> <li>Maximum daily application rate of 3 inches per day per acre</li> <li>Maximum annual application rate of 40 inches per acre</li> <li>Based on soil and crop moisture and/or nutrient requirements</li> </ul>
Golf courses or public parks with a low probability of body contact	Secondary Treatment Disinfection	
Airfields, farmland, and other properties owned or leased by the municipality	Secondary Treatment	
Farmland and properties not owned or leased by the municipality	Secondary Treatment	

Salina's Existing WWTP – Secondary Treatment + Disinfection





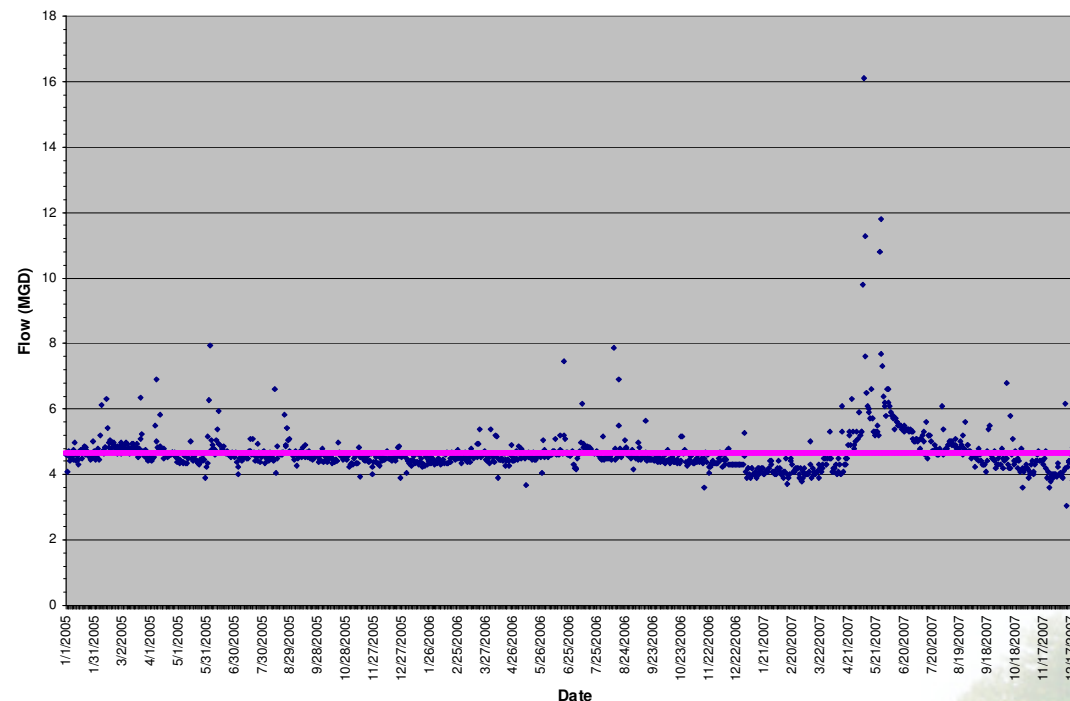
## Impacts to Downstream Water Rights

- Water rights regulated by Division of Water Resources (DWR)
- Who has the rights to the water that is normally discharged from the WWTP?
- City has rights to the water under these conditions:
  - It remains under the City's control
  - It is reused within their jurisdictional boundaries
- Does not mean that legal disputes could not occur in the future
  - Has not happened yet in Kansas
  - Downstream users can claim "injury" to water rights
- One irrigation user downstream of Salina before confluence with Saline River



# Wastewater Effluent Quantity

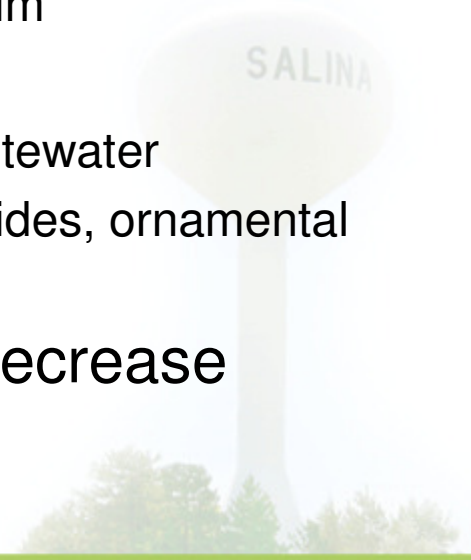
- Flow into wastewater treatment plant varies:
  - Hourly, Daily, Seasonally
- Always some base flow into WWTP
- Minimum flow (2005-2007) – 3.0 MGD





# Wastewater Effluent Quality

- Industrial use – suitability varies by industry
- Irrigation use – some potential concerns
  - Salinity
    - Affects plant's ability to uptake water
    - Burn leaf tissue
  - Sodium
    - Leads to breakdown of soil/reduced infiltration rates
    - Turf grass not particularly sensitive to sodium
  - Chlorides
    - Water softeners contribute chlorides to wastewater
    - Turf grass not particularly sensitive to chlorides, ornamental plants are
- Nutrients in wastewater effluent may decrease fertilizer requirements





# Reuse Applications – Municipal/Irrigation

- Well-practiced in Kansas
  - Hays, Colby, Hutchinson, others
- Public parks, athletic fields, golf courses, other municipal uses
- Some sites use well water/surface water for irrigation

Water User	Body Contact Classification	2006 Irrigation Water Usage <sup>(1)</sup>	
		Water Right Usage (gallons) <sup>(1)</sup>	Municipal Usage (gallons)
Bill Burke Park (City)	High	1,030,000	13,120,000
Soccer Complex (City)	High	-	6,118,000 <sup>(2)</sup>
Salina Municipal Golf Course (City)	Low	54,938,000	(3)
Salina Country Club	Low	52,436,000	(3)
Elks Country Club	Low	56,864,000	(3)
East Crawford Recreational Area (City)	High	-	1,171,000
Annual Total		165,268,000	20,409,000
Allowance for Water Losses (10%)		16,526,800	2,040,900
Daily Average (over 120 days per year)		181,794,800	0.19 MGD
Daily Average (over 120 days per year)			1.7 MGD

(1) Water right usage obtained from DWR for those rights that are owned by the water user.

(2) Usage high in 2006 due to new turf. Irrigation for established turf assumed to be 2007 usage.

(3) Potable municipal usage is for domestic purposes and not included in water reuse calculations



## Reuse Applications – Industrial

- Manufacturing processes
- Some industries may currently treat water further
  - Further evaluation needed to determine if industries can use reclaimed water
  - Most industries not located near WWTP
    - Could be served by an extension of the irrigation pipeline

Location	Industry	2006 Water Usage <sup>(1)</sup> (gallons)
Exide Corporation	Automotive Batteries	44,270,000
Philips Lighting Co.	Fluorescent Lighting	42,416,000
Metlcast Products	Gray/Ductile Iron Foundry	4,652,000
Great Plains Manufacturing	Agricultural Equipment	4,452,000
El Dorado National	Motor Vehicle Bodies	3,150,000
Annual Total		98,940,000
Allowance for Water Losses (10%)		9,894,000
Daily Average (over 260 days per year) <sup>(2)</sup>		0.42 MGD

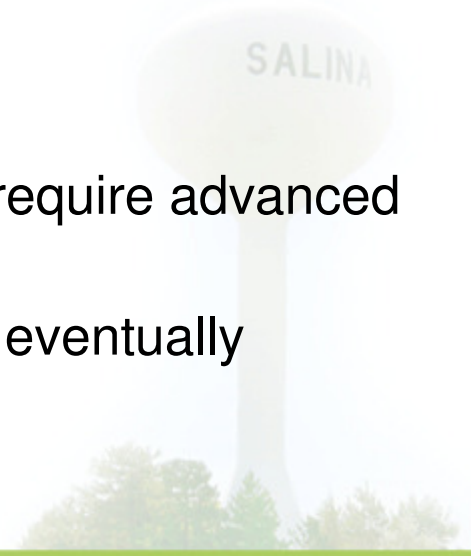
(1) Includes minimal potable water use unless otherwise specified

(2) Assumes 5 working days per week



# Reuse Applications – Groundwater Recharge

- Artificial recharge of aquifer
  - Recharge ponds, old river oxbow
  - Direct injection wells
- Federal guidelines
  - Drinking water standards
  - Minimum time retained in aquifer
  - Setback distances from wells
- Technical/Non-Technical Hurdles
  - “Yuck” factor/perceived contamination
  - Potential for build-up of chlorides – would require advanced water treatment processes
  - Inability of the aquifer to retain the water – eventually discharged back to river





## Reuse Applications – Direct Reuse

- Reuse for potable water purposes
  - KDHE says “last resort”
- Not currently practiced in the United States
  - Has been studied in CA, FL, CO
- Public health impacts
  - Pharmaceuticals, endocrine disruptors, personal care products
  - Nitrates
  - Viruses and pathogens





# Wastewater Treatment Plant Upgrades

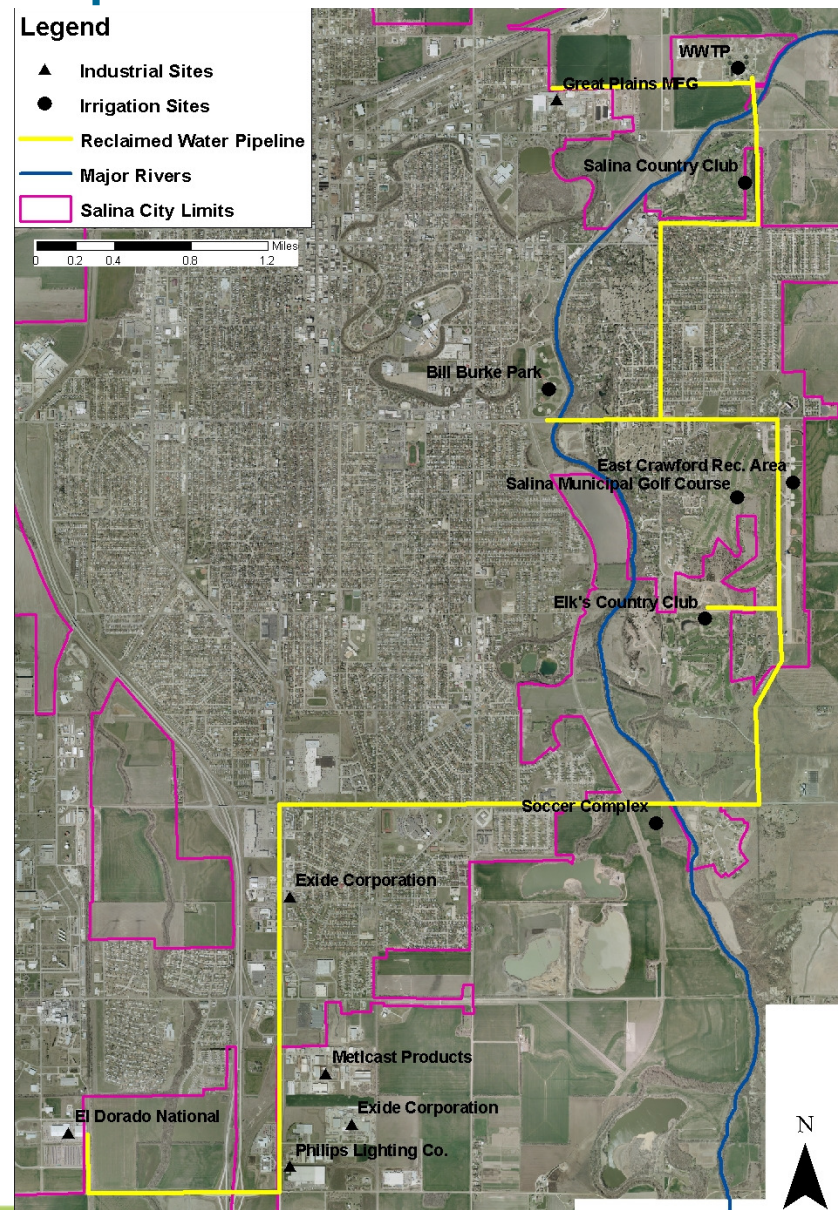
- Existing wastewater treatment plant
  - Secondary Treatment (trickling filters)
  - UV Disinfection
- For irrigation of high body contact areas (i.e. athletic fields)
  - Add filtration
  - Likely need additional disinfection
    - Further inactivation of pathogens
- For irrigation of low body contact areas (i.e. golf courses)
  - Likely no treatment improvements needed





# Other Infrastructure Requirements

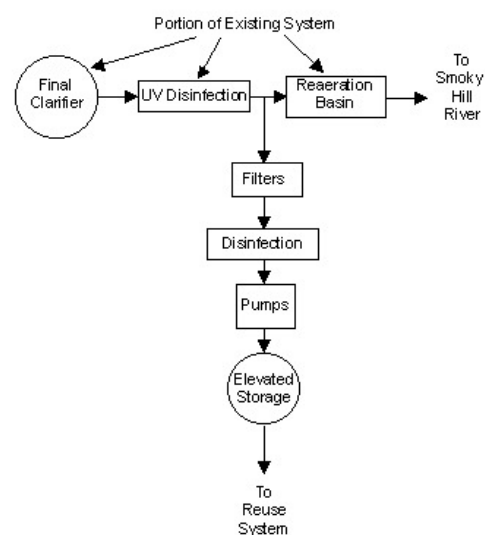
- Pumping and storage
  - Irrigation occurs at night (public access restricted)
  - Flow into WWTP lowest
  - Store water for use during off-peak hours
- Pipeline to serve irrigation and industrial sites
  - 6.5 miles of pipelines to serve irrigation
  - 6.3 miles of pipeline to serve industries



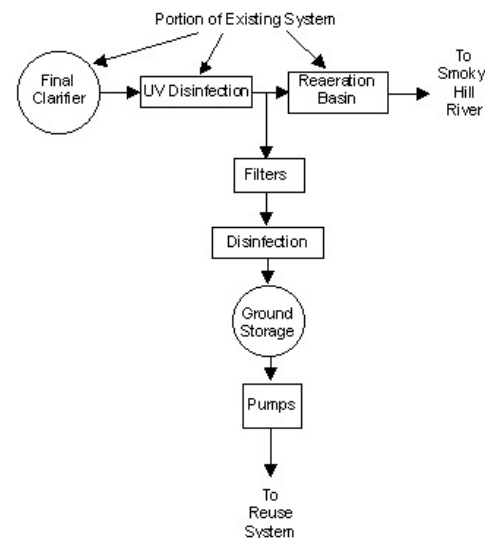


# Cost Estimate for Upgrades

- Cost Estimate
  - General - \$582,000
  - Filtration - \$2,022,000
  - UV Disinfection - \$2,624,000
  - Storage Tank/Pump Station - \$1,180,000
  - Distribution Piping - \$3,716,000
  - Contingencies (30%) – 3,037,000
- Total Construction Cost - \$13,161,000
- Engineering, Legal, etc (20%) - \$2,632,000
- Total Project Cost - \$15,793,000



OR





# New Sources of Supply





## New Sources of Supply



- Saline River
- Confluence of Smoky Hill, and Solomon Rivers
- Dakota Aquifer
- Kanopolis Reservoir
- Milford Reservoir
- Wilson Reservoir
- Water Assurance District Development
- Acquire Existing Water Rights
- Reservoir Construction





## Saline River

- Approximately 5 miles north of Salina
- Under-developed in terms of water rights
  - Opportunity for seniority
  - Availability for expansion
- Poor water quality – high salinity
  - TDS is 1,150 ppm vs 576 ppm at Smoky Hill River
  - Requires desalination treatment process (reverse osmosis)
- Subject to drought conditions similar to Smoky Hill R.
- Would likely use river bank filtration wells



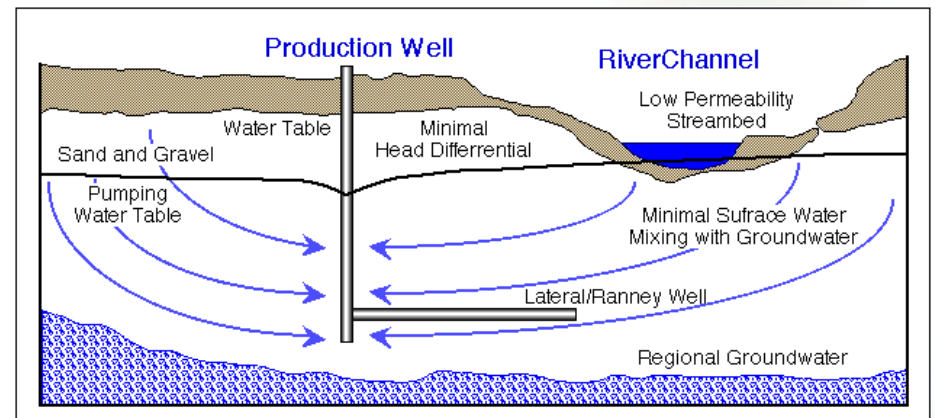
# Confluence of Smoky Hill and Solomon Rivers

- Approximately 13 miles northwest of Salina
- Under-developed in terms of water rights
  - Opportunity for seniority
  - Availability for expansion
- Poor water quality – high salinity
  - TDS is 1,150 ppm vs 576 ppm at Smoky Hill River
  - Requires desalination treatment process (reverse osmosis)
- More reliable flow conditions than Smoky Hill River near Salina
- Would likely use river bank filtration wells



## River Bank Filtration Wells

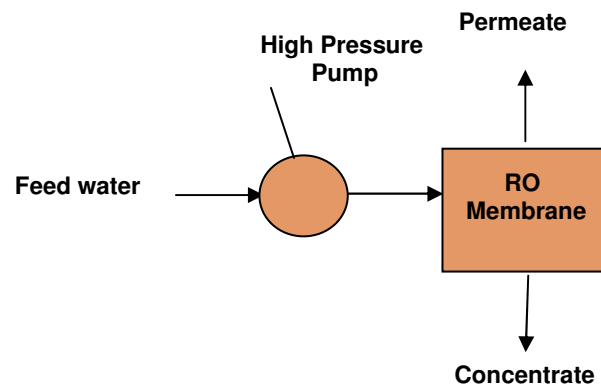
- Wells that withdraw from the aquifer adjacent to the river bank
- Withdrawal not limited to certain times of the year
  - Surface water intake limited to withdraw during October through June
- Provides some pre-treatment of the water
- Two options
  - Series of vertical wells
  - Single horizontal collector well





# Reverse Osmosis Treatment

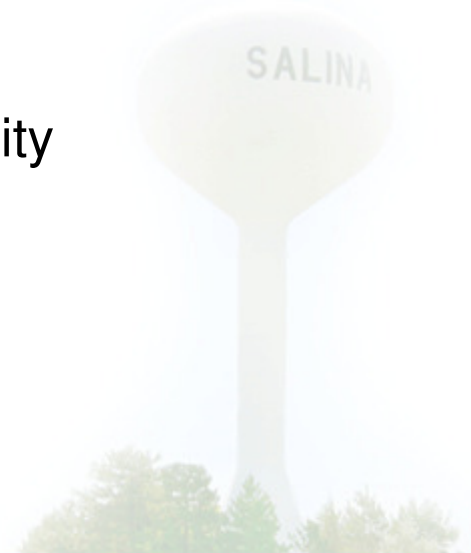
- Conventional treatment processes not capable of removing the dissolved salts and minerals efficiently
- Produces clean water (permeate) and concentrate (concentrated salts and minerals)
- Disposal of concentrate:
  - Discharge to surface water or sanitary sewers
  - Deep injection well
  - Evaporation ponds





## Dakota Aquifer

- Used for many uses in central and SW Kansas
- Lower unit forms valley walls of Smoky Hill River near Salina
  - Low yield wells
  - City of Gypsum – wells produce 45-50 gpm
- Upper unit to the north and west of Salina
  - Well yields from 50 to 300 gpm
- Variable water quality
  - Depending on location can be high in salinity
  - Salinity increases to the west
  - Varies from 250 ppm to 2,000 ppm





## Kanopolis Reservoir



- Approximately 27 miles southwest of Salina
- Owned and operated by the USACE to regulate flows in the Smoky Hill River
- Current yield projection – 6.5 MGD in 2047
  - During a 50-year drought
- Investigation of 2' pool raise to raise yield
  - Not considered a near-term possibility
- Current allocations – 1.0 MGD to Post Rock
- Current applications – 23.5 MGD
  - Reservoir potentially overcommitted
- Would require 27+ miles of pipeline to convey

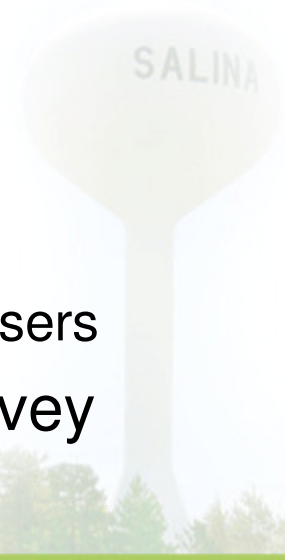




## Milford Reservoir



- Approximately 45 miles east of Salina
- Owned and operated by the USACE to regulate flows in the Republican River
- Better water quality than supplies near Salina
- Current allocations
  - 38 MGD in use (Westar Energy, Kansas River WAD #1)
  - 75 MGD currently not opened for allocations
- Different river basin – increases reliability
- Would likely require inter-basin transfer
  - Long permitting process with DWR
  - May encounter resistance from eastern water users
- Would require 45+ miles of pipeline to convey





## Wilson Reservoir



- Approximately 55 miles west of Salina
- Operated by the USACE to regulate flows in the Saline River
- Water quality – high in salinity
  - Would require reverse osmosis treatment
- Currently no storage allocated for supply
  - Has never been used for water supply
  - KWO investigating buying storage
- Would require 55+ miles of pipeline to convey





# Water Assurance District Development

- Municipal and industrial users along a river join together to purchase storage in upstream reservoir for drought periods
  - “Insurance policy” for water availability when streamflows are low
- USACE/KWO operate reservoir to release the stored flow to the Water Assurance District users
- Currently 3 water assurance districts in Kansas
- Salina owns water rights on the Smoky Hill River
  - No storage allocated for water assurance districts in Kanopolis Reservoir
- Currently irrigation users are not included in district
  - KWO is considering allowing them to be part of the district



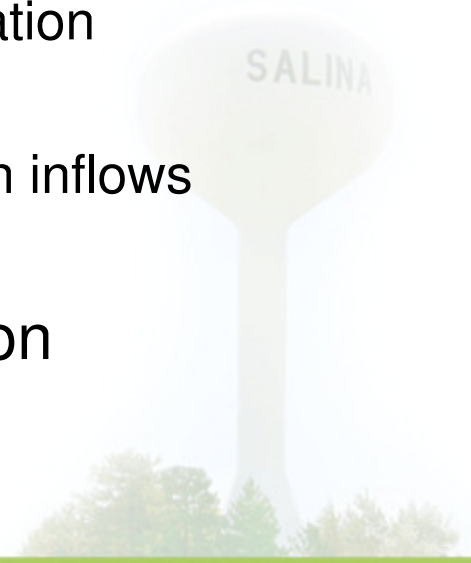
# Acquisition of Existing Water Rights

- Includes surface water and groundwater rights
- Common method in western Kansas
- Considerations for purchasing water rights
  - Find willing sellers
  - Find water rights that are senior to Salina
  - Find large water right volumes close to existing infrastructure
- Considerations for implementing
  - Wells would likely need to be replaced
  - Change in Point of Diversion from DWR (can only move a well at most 1/2 mile from current location)
  - Change in Use Made of Water and Change in the Place of Use for conversion to municipal and use in Salina
  - Permitted volume and rate likely reduced upon conversion



# Reservoir Construction

- Reservoir for water supply, recreation, flood control
- Considerations:
  - Need water right for diversion
  - Extensive permitting with DWR
  - Land purchase for dam, area covered by water, area for spillway, and mitigation
  - Possible road and utility relocations
  - Environmental impacts and possible mitigation
  - Development of recreation facilities
  - Sedimentation of reservoir and reduction in inflows
  - Intake, pump station, and pipeline
- Time for design, permitting, construction
  - Still need additional sources in the interim





# Alternatives Evaluation Criteria





# Evaluation Criteria



- What is important in comparing alternatives to one another?
  - Optimizes existing resources
  - Increases reliability during drought
  - Minimizes implementation risk
  - Expandable for future demand
  - Cost effective
  - Flexible for phased implementation
  - Minimizes environmental impacts
  - Desirable water quality
  - Permitability
  - Sustainability
- Next Meeting we will have you rate the relative importance of the criteria for alternatives evaluation.





# Discussion/Questions





## Next CAB Meeting



- February 5 or 12 – 6:00 PM
- Meeting Topics
  - Alternatives Evaluation Process
    - Identification
    - Preliminary Screening
    - Alternatives for Further Evaluation
    - Alternatives Evaluation

